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Manual

Version 2.0

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Content

FSSymphony

The program acts as smart interface between the Flight Simulator, FSUIPC and the PoKeys56E® Ethernet interface. FSSymphony V2.0 is compatible to the following flight simulators: FS2004, FSX, Prepar3D® V1.4 and V2.1. Version 2.0 supports both cockpit builders with no programming experience just by let them select the required function from a drop-down list, as well as user who want to get deeper in functionality. They can define own functions, including manipulating offsets and doing logical comparison.

The program can also act as bridge to the SIOC programming language. Each of the PoKeys56E® digital inputs, outputs, analog inputs and encoders can be assigned to a SIOC variable. This gives cockpit builders a maximum of flexibility and the opportunity to interface SIOC scripts to the PoKeys56E® interface.

Furthermore the PoExtBus for up to 80 additional output ports is supported and I2C bus has been introduced for 12 additional servo outputs.

A variety of examples for user defined functions and comprehensive description are included in the download package.

General

Disclaimer

Every effort has been made to ensure that the shown hardware and wiring examples are correct, however, I accept no responsibility for any errors or omissions or for any direct or consequential losses that may occur.

Safety note

For all hardware examples shown in this documentation it is assumed that the reader is familiar with the fundamentals of electronic circuits as well as electrical hazards and safety.

Compatibility

FSSymphony has been successfully tested with Microsoft® Flight Simulator 2004, Flight Simulator X, Prepar3D® V1.4 and Prepar3D® Professional V2.1. Microsoft XP®,Vista®, WINDOWS7®. 64 bit compatibility was tested with WINDOWS7®.

PoKeys57E is fully compatible to PoKeys56E according to the manufacture statement.

Constraints

FS.Symphony supports PoKeys56E® devices. Compatibility to PoKeys56U® is not planded for the future.

Important Note

The configuration file of version 1.1 is not compatible to version 1.5. Form version 1.5 onwards the configuration files are backwards compatible.

Prerequisites

FSSymphony needs a registered copy of FSUIPC running on the PC with the FS installation. If you run FSSymphony from a remote PC than WideFS has to be installed on that PC.

- The Microsoft® .Net Framework 4.0 and Power Packs 10.0 have to be installed on your computer. You can get it free of charge from the Microsoft Download Center. With the FSSymphony version 1.1 and onwards the framework gets automatically installed during the setup procedure if not already available on your computer.

Further Developments

FSSymphony is constantly improved and further developed. If you have feature requests please drop me an email: ruediger.ebert@flying-the-winglets.de

Credits

Thanks to Peter Dowson for his great work on FSUIPC

FS.Symphony uses the FSUIPC Client DLL for .NET by Paul Henty

New Feature Version 2.0

- Introducing the expert mode for users who want to define their own functions
- I2C status indicator

Fixed bugs

- B737 Light Test now includes gear indicators
- Function ‘Set High State’ with the PoExtBus dialog fixed

Improved

- B737 Autobrake System: 3sec gate for throttle implemented

PoKeys56E Supplier

PoKeys56E® is distributes by FlightSimParts.eu, Belgium. For information check their website: http://www.flightsimparts.eu/Shop_Electronics_Pokeys56E.html

Trademarks

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SW-Installation and Initial Set-up

Prerequisite:

FSSymphony requires at least the firmware version 3.0.41 installed on the PoKeys56E® devices.

The latest PoKeys56E® firmware can be found here:

http://www.poscope.com/pokeys56e.

FSSymphony requires the MICROSOFT 4.0 Framework.and and Power Packs 10.0. If the framework is not installed on your computer this will be done automatically during the set-up procedure. Make sure that an Internet connection is available for that step of the installation procedure.

Backup of an existing Configuration

Backup your existing configuration file prior installation of FSSymphony Version 2.0. Otherwise your configuration will get lost during the installation process. Use the 'Export Configuration' function of FSSymphony to perform this task.

➔ *File / Export Configuration*

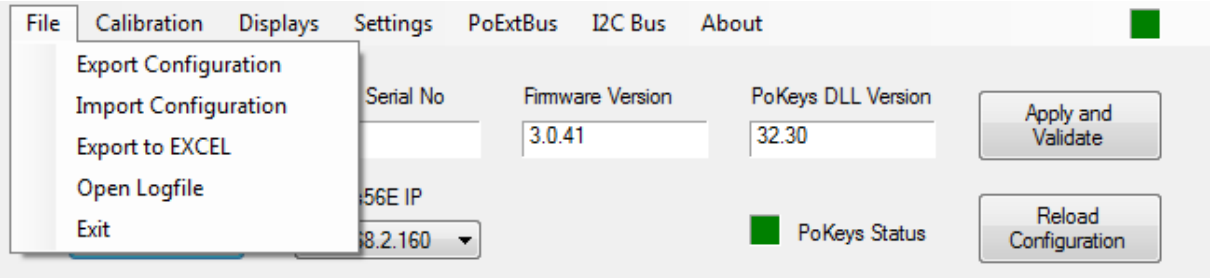


Figure 1: File Menu. From version 2.0 onwards the menu items are named 'Backup Configuration' and 'Restore Configuration'

Installation Procedure

Due to the reason that FSSymphony uses the .net feature 'ClickOnce' installation, make sure that you are logged in as the user who wants to use the application. ClickOnce-deployed applications are considered as 'low impact', in that they are installed per-user, not per-machine. No administrator privileges are required to install the application. In order to prepare the installation unzip the content of the FSSymphony V2.0 download package in a directory of your choice.

➔ Export Configuration of existing installation (if applicable)

➔ Uninstall previous version of FSSymphony with WINDOWS 'Add/Remove programs' function (if applicable)

➔ Run the setup.exe

➔ Connect your PoKeys56E® device(s) to the network

➔ Run FSSymphony from the WINDOWS Start menu

FSSymphony needs some network ports for proper communication, thus your firewall might ask you for confirmation with the first usage of the program.

Note: FSSymphony does not use any own port definitions, but the defined standard ports e.g. for IOCP, WideFS, and PoKeys56E® interfaces have to be enabled.

Restore Configuration

If you want to restore the saved configuration file open the File menu and select 'Restore Configuration'. The imported configuration gets automatically saved.

If the backup file was saved with FSSymphony prior V1.5.0 and only in this case proceed as following:

➔ Open the exported configuration file with the WINDOWS notepad

Insert the following below the <Configuration> tag :

<FSSymphony Version="1.1.5.0" />

The result should look like the following:

```
<?xml version="1.0" encoding="utf-16"?>
<Configuration>
        <FSSymphony Version="1.1.5.0" />
```

➔ Save the configuration file

➔ IRestore the configuration file into FSSymphony Version 2.0

First Start of FSSymphony

Prerequisite:

- At least one PoKeys56E® device with fixed IP address is connected to your network. Use the PoLaps software to assign an IP address to the device.

If the above condition is fulfilled then

➔ Start FSSymphony und wait for a few seconds.

During the splash screen is visible FSSymphony performs a discover process on the network to find the connected PoKeys56E® devices.

After this the FSSymphony main dialog appears. The devices found are listed in the 'PoKes56E IP' selection box. If one or more of the PoKeys56E® devices were not detected check the physical and logical network configuration.

➔ Click the button 'Connect PoKeys' for each of the found PoKeys56E® device

The color of the 'PoKeys Status' indicator should change to green. FSSymphony shows additional information regarding the connected device at the top line. These are User ID, Device Serial Number, Version Major, and Minor.

If the network connection to a PoKeys56E® device gets lost, FSSymphony will try to reconnect. While this process is performed, the color of the status indicator will be orange.

➔ Start the FS Flight Simulator and press the button 'Connect FSUIPC'. With the connection established the 'FSUIPC Status' light turns to green.

➔

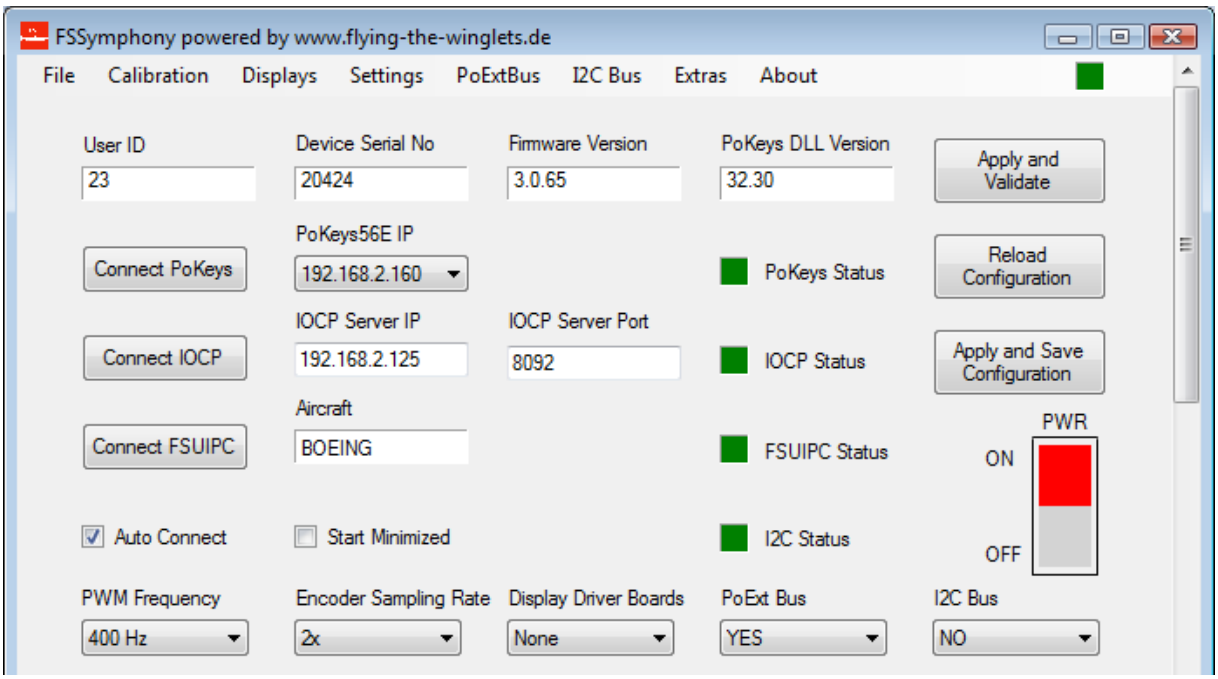


Figure 2: Main Dialog

If you want to interface the PoKeys56E® device to IOCP (SIOC) then enter the IP address and the port number in the relevant fields. Start the IOCP server and press the button 'Connect IOCP'. With a successful connection the 'IOCP Status' light will change color to green.

Note:
If the IOCP server has terminated the communication to FSSymphony, e.g. with pushing the 'Reload' button on the SIOC software, you have to restart FSSymphony.

Saving Configuration

At this point of the configuration it is a good idea to save the current settings.

➔ Press the '*Apply and Save Configuration*' button

Application Description

Start Options

Auto Connect If you want FSSymphony to connect with the next start automatically to the PoKeys56E® devices, IOCP server, and FSUIPC then check the 'Auto Connect' box

Start Minimized In order to start the application in the system tray check this option

Validate and Apply

In order to validate the configuration press the button 'Validate and Apply'. Once the validation has been completed FSSymphony opens Notepad and shows the results.

Note: If the validation shows errors, the configuration is not applied.

```
FSSysmphony: Validation Report
Date: 2012-11-19 10:30:43
IP Address: 192.168.2.160


- Error: Configuration mismatch, Pin 2 : For PWM outputs use pins 17 through 22
- Error: Configuration mismatch, Pin 3 : Check input / output assignment
- Warning: SIOC variable number missing, Pin 5


Validation result: 3 warnings / errors found


Configuration was not applied due to error report!
```

Figure 3: Example of a validation report

Apply and Save Configuration

Configuration changes get active and saved in a XML file. The content of that file will be automatically loaded with the next start of FSSymphony.

Reload

With the 'Reload' button the last but one configuration is re-called.

File Backup / Restore

This feature allows you to export the actual configuration. The usage of this function is strongly recommended for configuration backup. With restoring a configuration the content is automatically applied and saved.

Status Indicators

For each digital input and output a status light is available which shows the logical state of the corresponding PoKeys56E® pin.

Figure 4: Status indications of inputs and outputs are supporting system integration and debugging

For analog and encoder inputs the raw values are displayed instead of a status signal.

Figure 5: For analog inputs the digital equivalent is displayed

FS Controls and Extended Functions

FSSymphony supports large collection of standard FS controls via FSUIPC. Thus controls are directly selectable and can be assigned to any of the PoKeys56E® I/O pins. This is by far the easiest method to hock up your flight simulator hardware to the FS without the need to deal with offsets, bits, and bytes.

Moreover, FSSymphony provides extended functionalities by internal logic. Extended functionalities are for example: brake pressure indicator for B737, autobrake system for B737, flap position indicator, B737 auto brake system, and other extensive functions.

FSSymphony offers direct access to functions from Project Magenta B737 GC, MCP and System, as well as TSR System B737, Jet 45. Access to other cockpit software and add-on's will be available in future releases.

For more information see chapter 'General Options'

Configuration of Inputs and Outputs

For each of the 55 PoKeys56E® I/O pins you can individually determine whether it should act as

- Digital Input
- Digital Output

In addition certain pins can be used as

- Analog Input
- PWM Output
- Encoder Input

Pins which are not used should be set to 'Not used'.

Note:
Starting with FSSymphony V1.1 the Pin Assignment is automatically performed with the selection of a predefined FS Control or Extended Function. Individual selection is still possible.

Note:
- Due to PoKeys56E® limitations pins 5 and 6 must both set either input or output.

- Pin 54 will set the PoKeys56E® device into the 'Bootstrap' mode, in case that this pin is connected to 'GND' with power on. For that reason you should use pin 54 either as output or as input for a push button but never as input for a switch which could be closed during power on sequence.

Digital Outputs

Digital outputs can be assigned either to FS Control or a SIOC variable. FS Controls for output assignments are characterized either by the extension 'LIGHT' or 'Gate'.

Figure 6: Sample of input and output assignments

Digital outputs, labeled with 'Light' can be blanked with 'Master Battery Switch' OFF. If you want to use this feature, select *'Blank indicators with 'Master Batt Switch'* off'on:

➔ *General / Settings*

For test purposes a *'Master Batt Switch'* is provided on the FSSymphony main dialog.

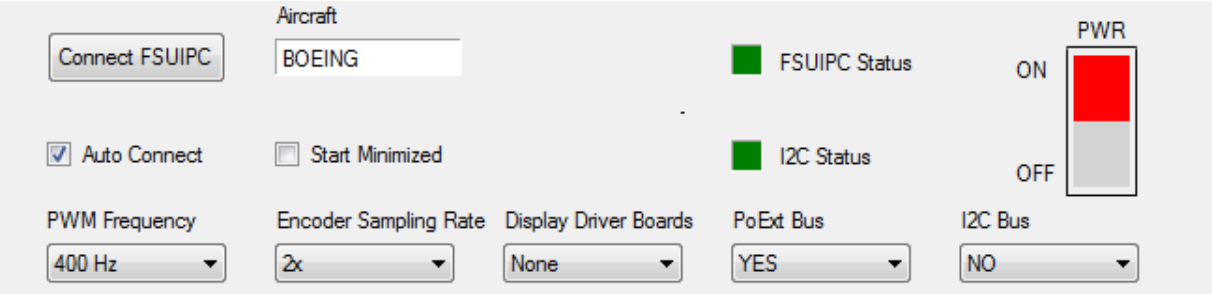


Figure 7: Master Battery switch (PWR) for test purposes

Digital Inputs

Digital inputs can be assigned either to a FS Control and / or SIOC variable. FS Controls for input assignments are characterized by the extension 'SW', regardless whether a switch, pushbutton or rotary is connected.

Note: With the expert mode a separate extension for pushbuttons has been introduced.

Analog Inputs

The analog inputs can be assigned directly to the FSUIPC joystick calibration facility or to any other analog control input, e.g. Project Magenta GC display brightness, or to a SIOC variable.

FS Controls for analog assignments are characterized by the extension 'Pot', e.g. 'Elevator Axis Pot'. The digital output range for the analog inputs is from 0 to 4095 (+3.3V). Pins 41 through 47 can be used for analog input purposes.

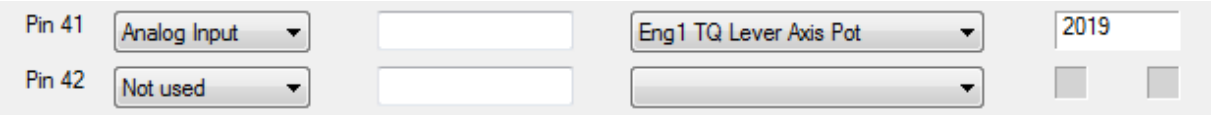


Figure 8: Example: The analog value of a potentiometer connected to the input pin 41 is applied to the FSUIPC Joystick calibration facility for the TQ lever of ENG 1

The numerical indication on the right side of the analog assignment is for debugging and functional test. It shows the actual digitized analog signal.

Analog Input Voltage	Digitized Value
0V	0
3.3V	4095

For the correct connection of potentiometers to PoKeys56E® refer to the PoKeys56E® User's manual.

Encoders

For each encoder 2 inputs of the PoKeys56E® are required. With the selection of the first encoder input pin (Encoder A) the second input is automatically allocated. Encoder inputs can be assigned either to a FS Control or SIOC variable. FS Controls for encoder assignments are characterized by the extension 'Encoder', e.g. 'Kohlsman (Baro) Encoder'.

If you have connected one or two display boards from flightsimparts.eu the pins 9-11, and 23-25 are used for display control and therefore not available for encoders. Same with PWM outputs: The pins 17 – 22 might be used as PWM outputs, depending on your pin assignments.

For encoder compatibility issues check the web site
http://www.flightsimparts.eu/simulator.html.

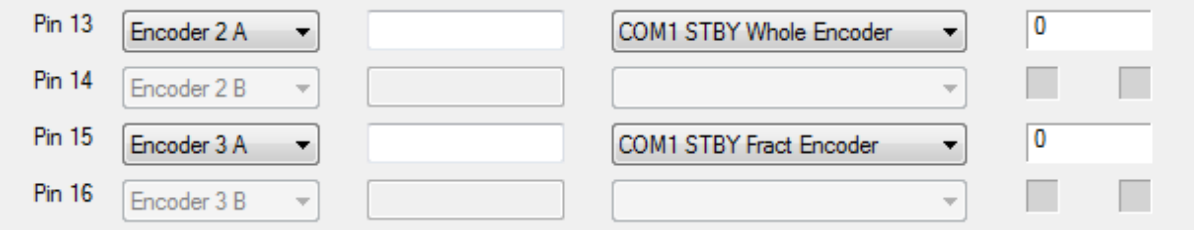


Figure 9: Example COMM1 radio encoder assignment

The numerical indication right to the encoder assignment is provided for debugging and functional test. The number is changing with each encoder detent. Depending to the used type of encoder you may have to set the encoder sampling rate either to 1x, 2x, or 4x.

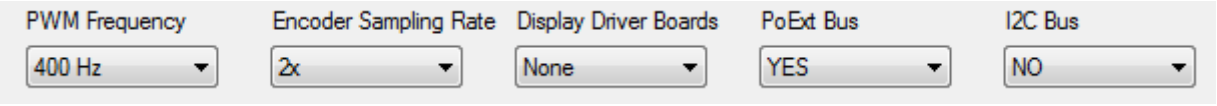


Figure 10: Configuration 'Encoder Sampling Rate'

The 'Encoder Sampling Rate' can be set separately for each of the connected PoKeys56E® devices.

Pulse Width Modulation

FSSymphony supports the PWM feature of PoKeys56E® as following:

- Predefined PWM frequencies for various applications
- Servo support, e.g. for gauges

For each connected PoKeys56E devices you can select one of the following PVM frequencies:

- 100 Hz
- 150 Hz
- 400 Hz
- 1.000 Hz
- Servo

Six Outputs (pins 17 – 22) can be used for PWM. The PWM Frequency can be set separately for each connected PoKeys56E® device.

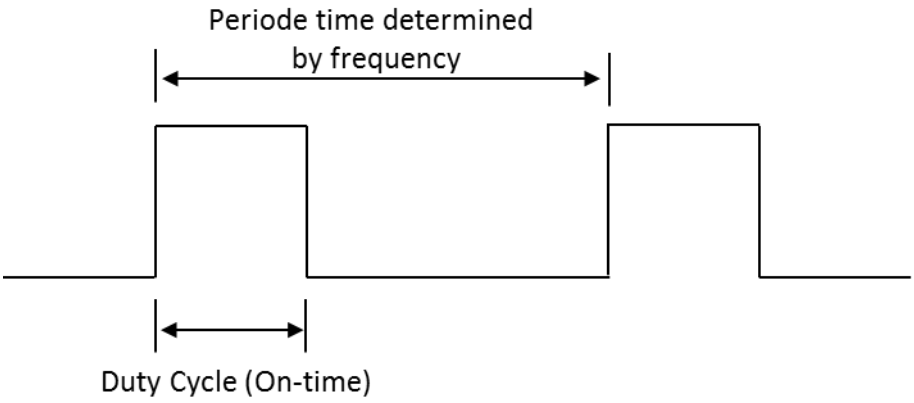


Figure 11: Pulse Width Modulation basics

Servo Example

For the connection of gauges the special assignment ‘Servo’ is provided as PWM frequency. With the ‘Servo’ configuration a PWM frequency of 50 Hz is used.

For calibration of the connected servo’s (gauges) go to the ‘Calibration’ menu and select ‘Servo’. Follow the instruction on that page and save the calibration data.

Note for SIOC users:
By means of an assigned SIOC variable you can changes the pulse with (On-time) between ~ 0.8 ms and ~ 2.1 ms. This corresponds to a variable range from 0 to 4095.

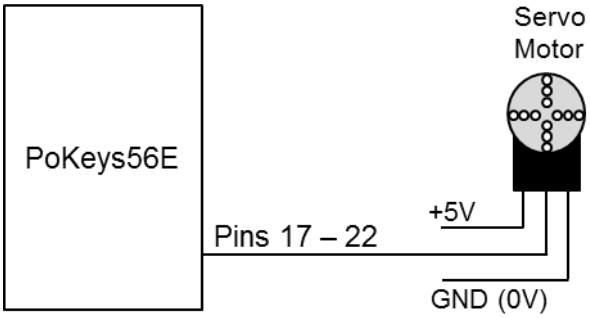


Figure 12: Example of servo motor connection to a PoKeys56E®

Value	Pulse Width (On-time)
0	0.8ms
4095	2.1ms

Note:
Another way to control devices with PWM from FSSymphony is available via the I2C bus. For more information see chapter ‘I2C Bus’.

Backlit Control Example

Another example for PWM is the LED backlit control. For best results use 400Hz PWM frequency. The brightness is controlled with changing the 'ON' time of the PWM signal.

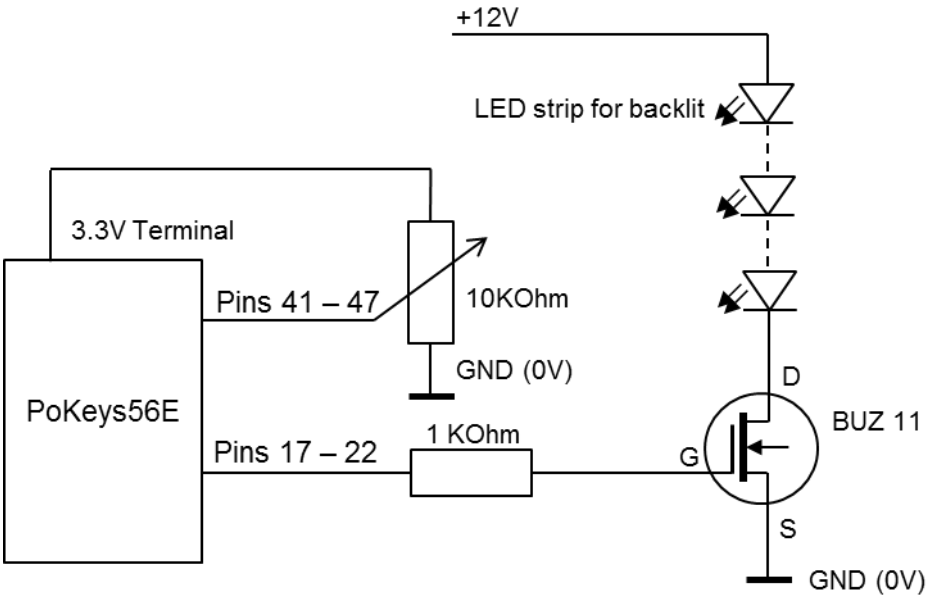


Figure 13: Example for backlit dimming with PWM and a power MOSFET

For B737 implementation see chapter 'B737 Goodies'

Simple SIOC script to control PWM with a potentiometer:

Prerequisite:

- Potentiometer connected to one of the PoKeys56E® analog inputs
- The analog input and the PWM output are assigned to the same SIOC variable

SIOC:

var 0015, name PWMExam // assign the pot and the PWM output both to var 0015

That's all what you have to do. Each change of the analog input signal will be fed to the PWM output.

Of course, you can also do some processing prior applying the analog input signal to the PWM output. In this case use different SIOC variables for input and output.

General Options

In order to include the required functions into the list box for 'FS Controls and Extended Functions', open:

➔ *Settings / General*

After saving the selected features restart FSSymphony.

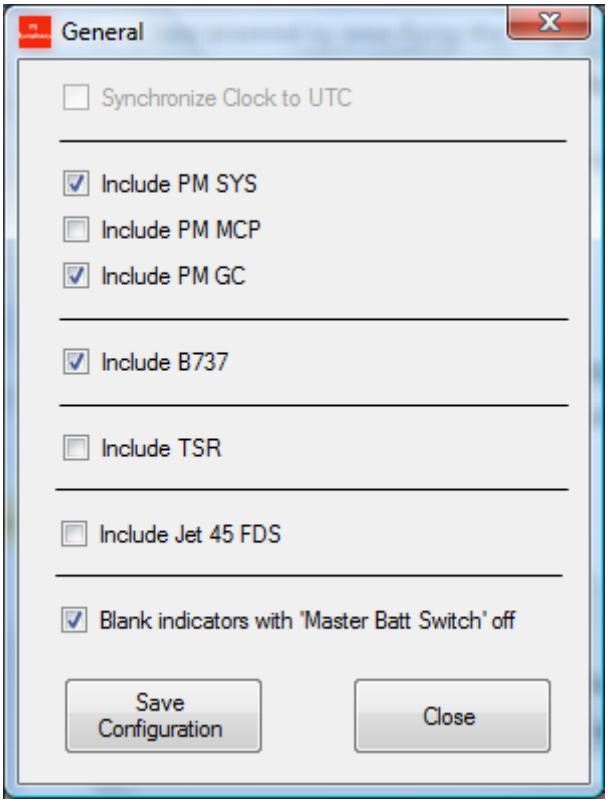


Figure 14: General options menu

Note:
Select only the needed function, because this improves the clarity and readability of the ‘FS Controls / Extended Function’ drop down list.

Network Transfer Protocol

Standard protocol for network communication with PoKeys56E® is TCP / IP. Form version V1.1 Beta 6 onwards FSSymphony supports beside TCP/IP also UDP (User Datagram Protocol) as network transfer protocol. UDP has less overhead in the data communication as TCP/IP and might have some advantages regarding speed, depending on your network environment.

➔ *Settings / Network*

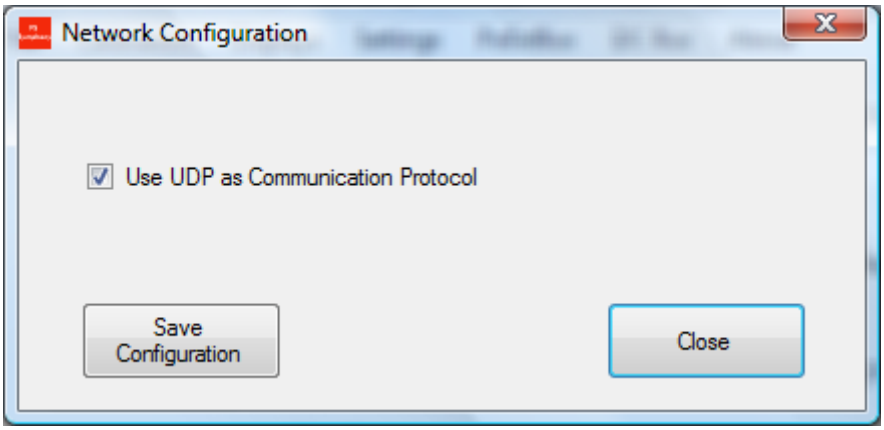


Figure 15: Network protocol configuration

Display Configuration

FSSymphony supports the display driver board from FlightSimParts.eu. The configuration is straight forward and needs only a few mouse clicks. Each of the connected PoKeys56E® devices can manage 2 display cards, with 8 digits each.

Prerequisite:

- Number of connected display driver boards selected on FSSymphony main dialog form

➔ *Displays / Configuration*

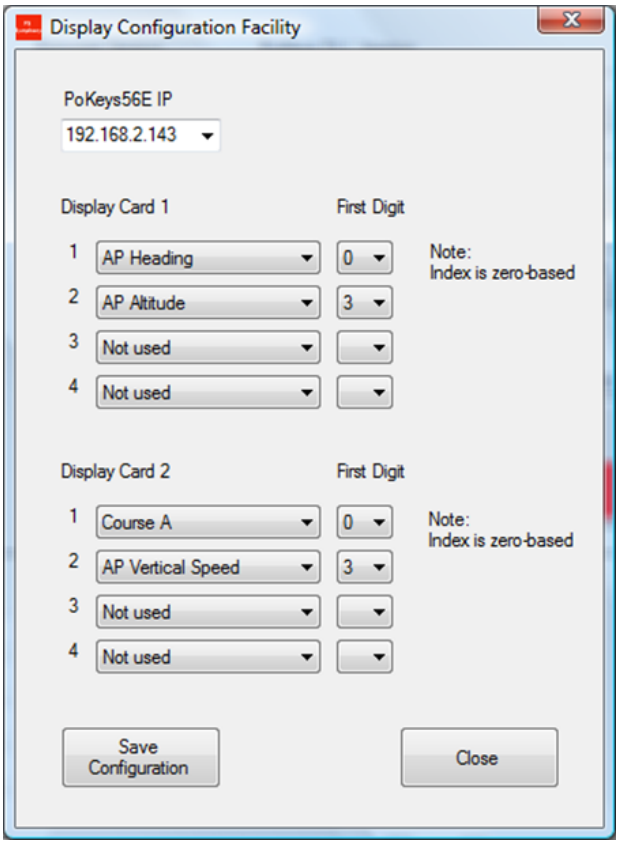


Figure 16: Display configuration dialog

For each display card you can assign up to 4 displays, limited to 8 digits in total.

Example:
As demonstrated in the figure ‘AP Heading’ with 3 digits starts with the fist digit at index ‘0’. ‘AP Altitude with 5 digits starts at index ‘3’. The groups 3 and 4 cannot be used in that case, because ‘AP Heading’ and ‘AP Altitude’ need in total 8 digits.

Servo Calibration Facility

FSSymphony supports servo driven gauges connected to PoKeys56E® pins 17 – 22 (PWM) and via I2C bus.

Examples for gauges are the B737 flap position indicator and B737 brake pressure gauge. Furthermore you can connect any servo driven gauge and control them via SIOC.

Prerequisite for servo control via PoKeys56E®:
- Make sure that you have selected ‘Servo’ as ‘PWM Frequency’ on the FSSymphony main dialog page (not relevant for PWM via I2C).

Then open:

➔ *Calibration / Servo / Generic*

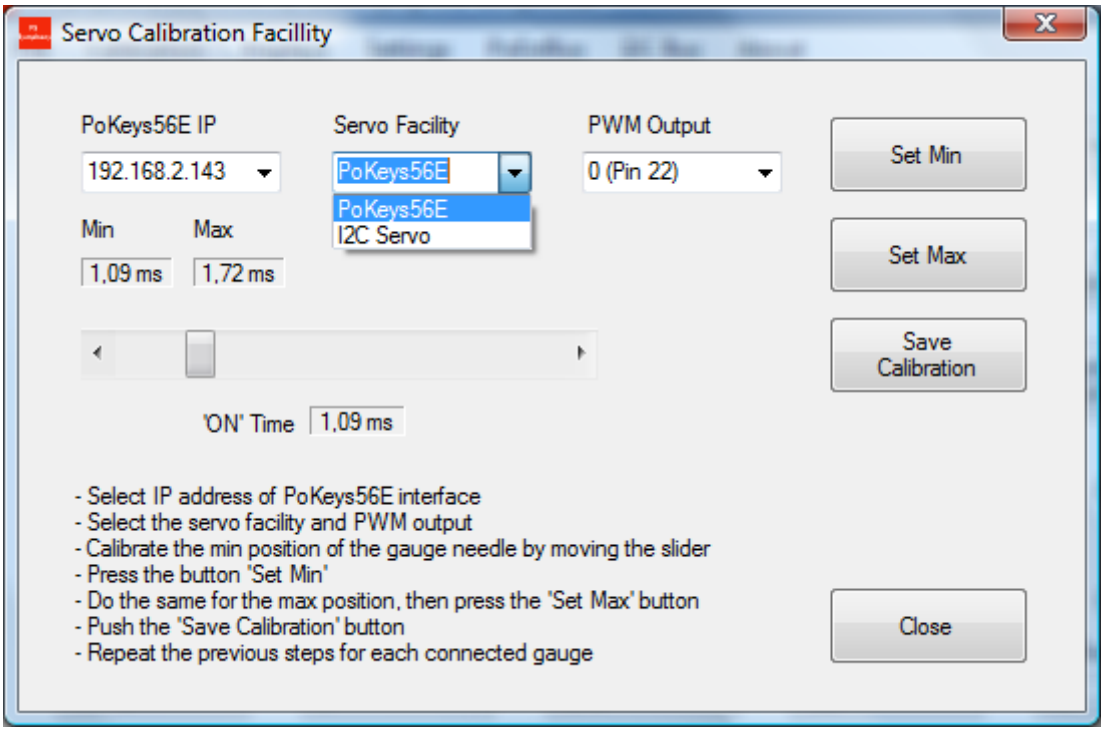


Figure 17: Servo Calibration Facility

In order to calibrate a gauge follow the instructions given in the ‘Servo Calibration Facility’ dialog.

Note:
Depending on the mechanical construction of the gauge min / max might be either on the left side or right side of the slider.

Note:
Do not use the Servo Calibration Facility to calibrate the B737 Flaps Position Indicator. Instead use the dialog ‘B737 Flaps Position Indicator Calibration’.

PoKeys Extension Bus

FSSymphony supports the PoExtBus bus feature which lets you add up to additional 80 digital outputs by external shift registers. This feature is available for each connected PoKeys56E® device.

➔ *PoExtBus / Configuration*

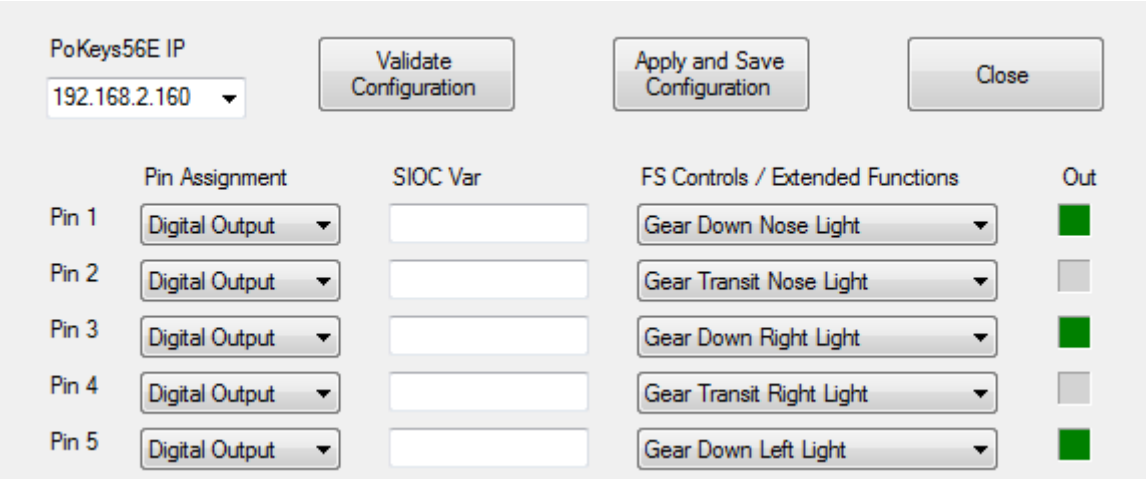


Figure 18: PoExt Bus configuration dialog

Extension pins are counted from 1 to 80.

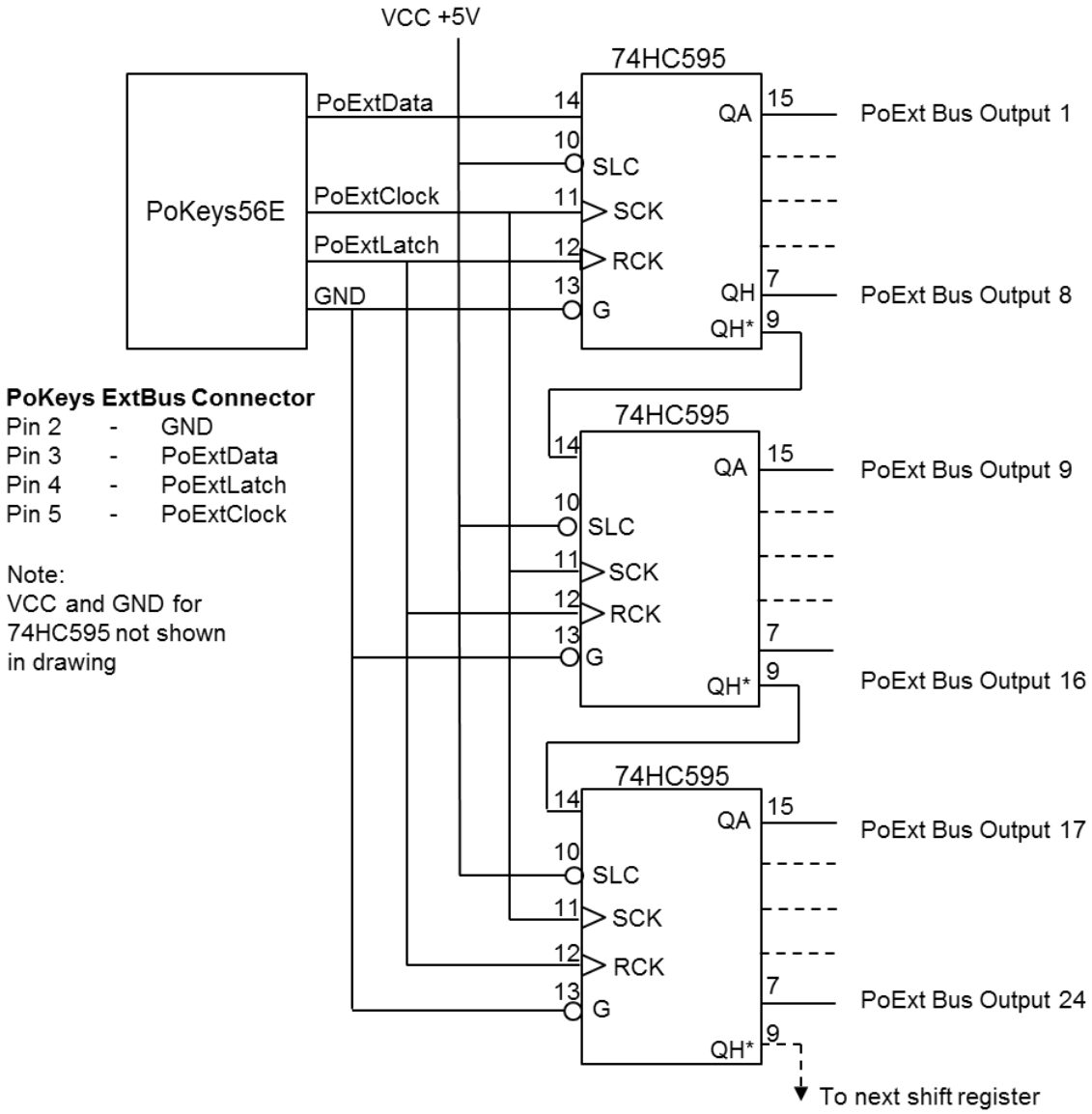


Figure 19: Example for 24 additional outputs via PoExt Bus. Expandable for up to 80 outputs.

For detailed information on hardware requirements see PoKeys56E® user's manual.

Note:
PoKeys56E® provides a dedicated connector for the extension bus. If, in addition to the PoExt Bus, you also want to use the I2C bus, pins 35, 36, and 37 are automatically assigned for the extension bus.

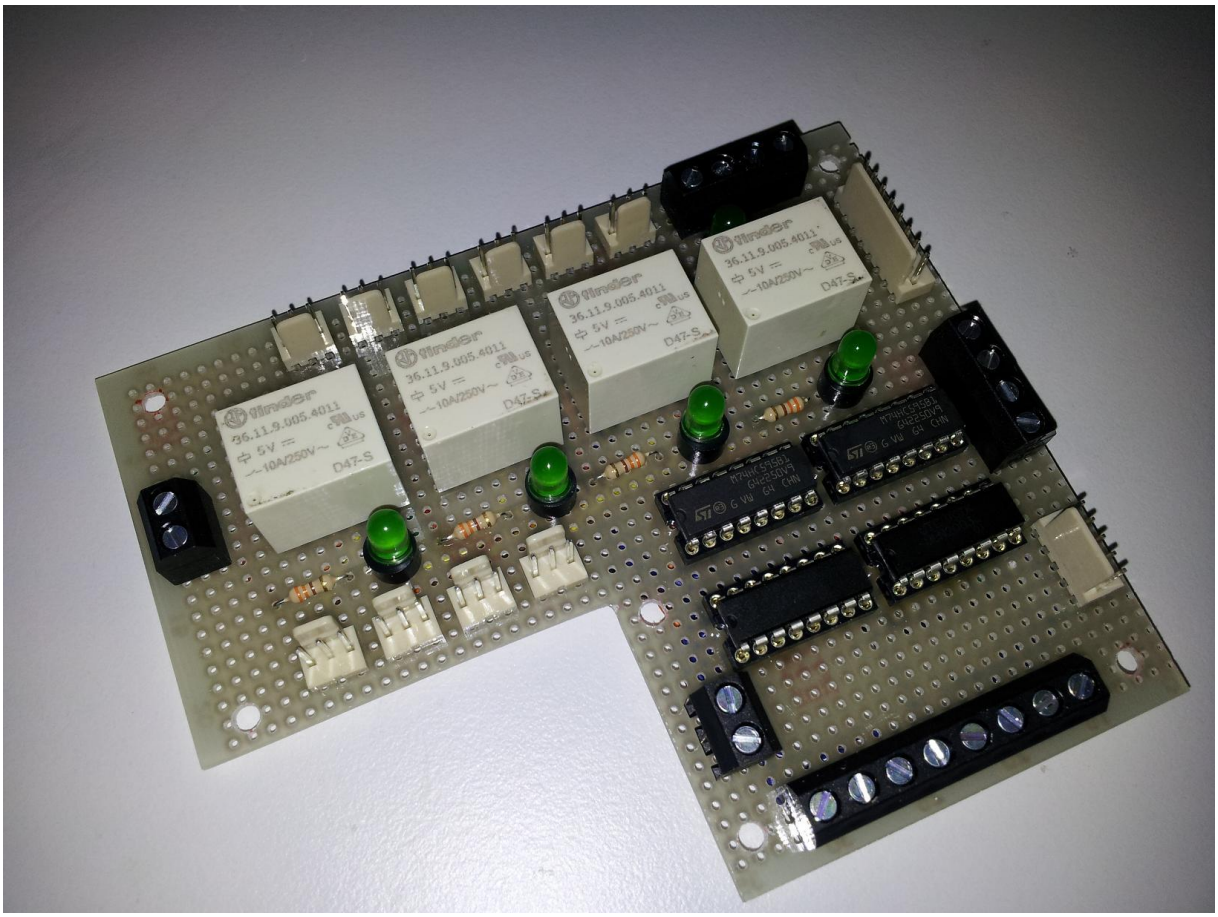


Figure 20: Example of an output card, using the PoExtBus

I2C Bus

Starting with version 1.5, FSSymphony offers the option to utilize the I2C bus feature of PoKeys56E®. As a first feature the support of additional 12 PWM outputs via a single integrated circuit has been implemented. I²C uses only two bidirectional open-drain lines, Serial Data Line (SDA) and Serial Clock (SCL) for data communication. This allows a simple wiring. However, for longer distances special driver circuits are required.

The mentioned 12 channel PWM circuit is from HT Hobby Electronic, UK. The circuit is very easy to handle and reasonably priced.

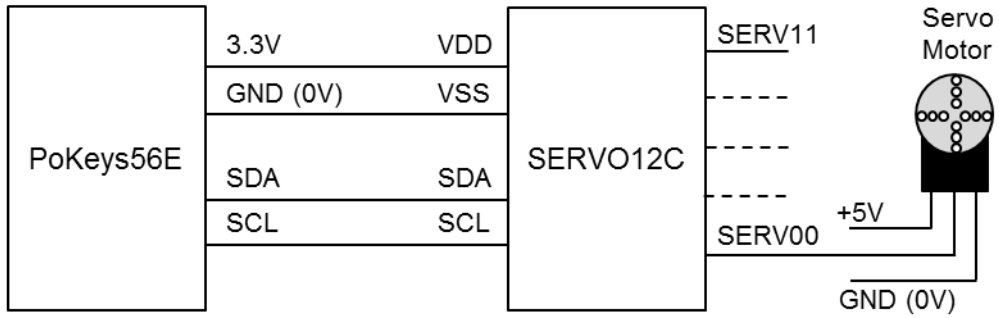
Component name: SERVO12C

Link to HT Hobby Electronic: http://www.hobbytronics.co.uk/servo-controller-12ch-ht?keyword=12%20channel

The IC2 Bus is available on the PoExt Bus connector. For more information see PoKeys56E® User's Manual.

Note: Connect VDD (pin of SERV12C) to the 3.3V terminal of the PoKeys56E®. VSS to GND.

Note: For the time being FSSymphony requires that the I2C address of the SERVO12C circuit is set to ‘40’ (default).



PoKeys ExtBus Connector

Pin 1	-	5V
Pin 2	-	GND
Pin 3	-	SDA
Pin 5	-	SCL

Figure 21: Connection of the SERVO12C PWM circuit via I2C to the PoExt Bus connector. For more information see SERV12C data sheet from HT Hobby Electronic.

Note:
Do not connect the VDD of the SERVO12C to +5V. Connect it as shown in the above drawing to + 3.3V.

In order to enable the I2C bus for a PoKeys56E® interface, select ‘YES’ in the I2C Bus list box on the FSSymphony main dialog page.

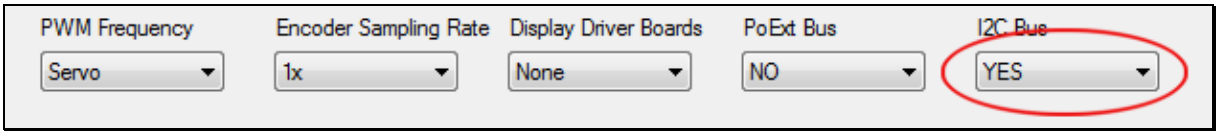


Figure 22: Enabling I2C bus for the selected PoKeys56E device

Note:
The selection of the PWM Frequency is not relevant for the servos connected to the I2C bus.

For the configuration of the 12 PWM channels FSSymphony provides a dedicated dialog:

➔ *I2C Bus / Servo Configuration*

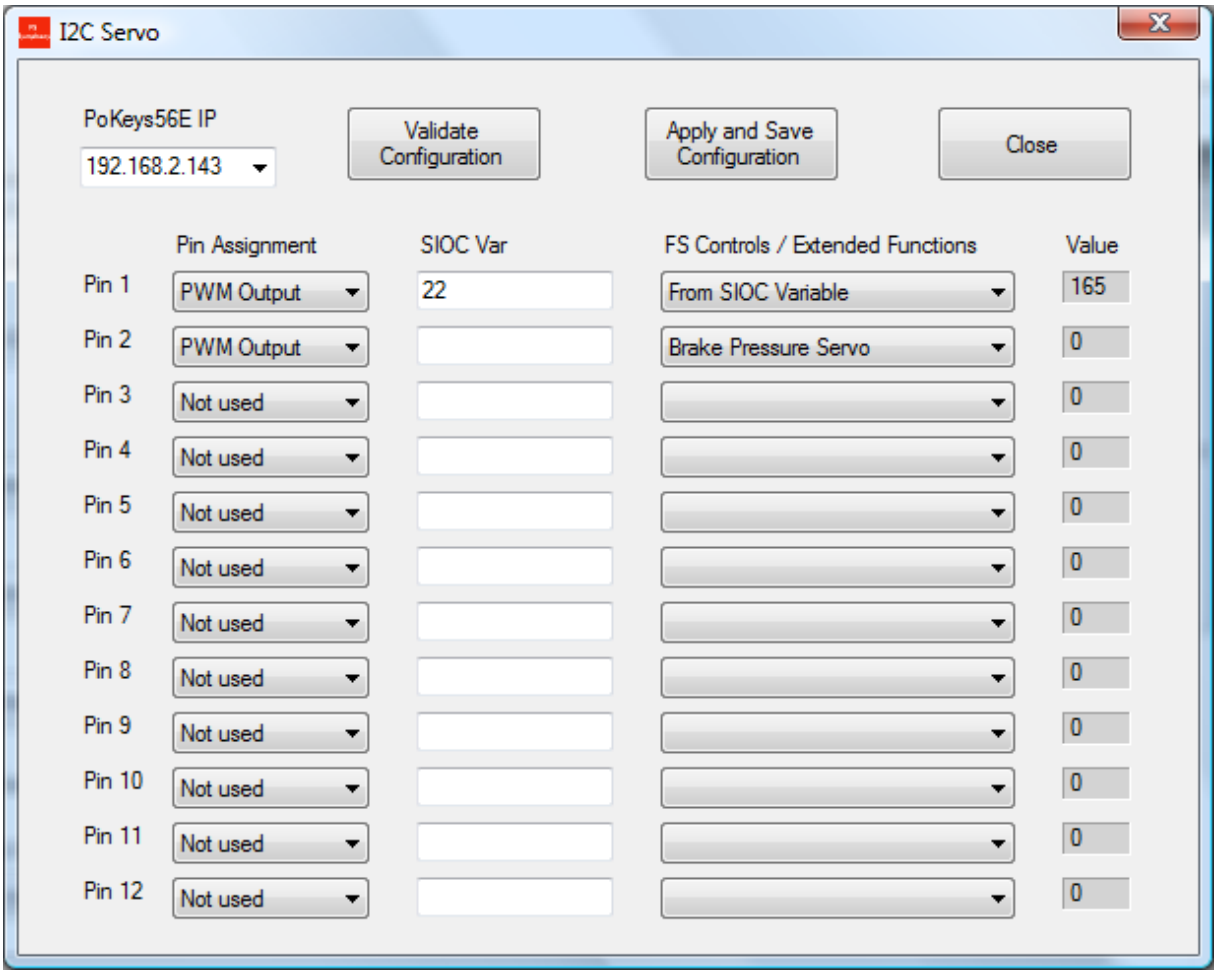


Figure 23: Servo configuration dialog for the 12 channel I2C PWM circuit, SERVO12C

In order to support integration the PWM input value is displayed for each channel. Please note, that this value has passed the calibration facility and is matched by the min / max calibration.

FSSymphony supports the so called 'extended Mode' of the SERVO12C. This means the PWM output signal can vary between 0.6ms and 2.4ms. This allows most servos to rotate through almost 180 degree.

The outputs can be set by both SIOC and FS Controls. For the time being only 'Brake Pressure Servo' is available as pre-assigned instrument. The next release of FSSymphony will include B737 overhead gauges.

Via SIOC any servo based gauge can be controlled. The variable range is from 0 to 255.

Value	Pulse Width (On-time)
0	0.6ms
255	2.4ms

The servo calibration is performed here:

➔ *Calibration / Servo / Generic*

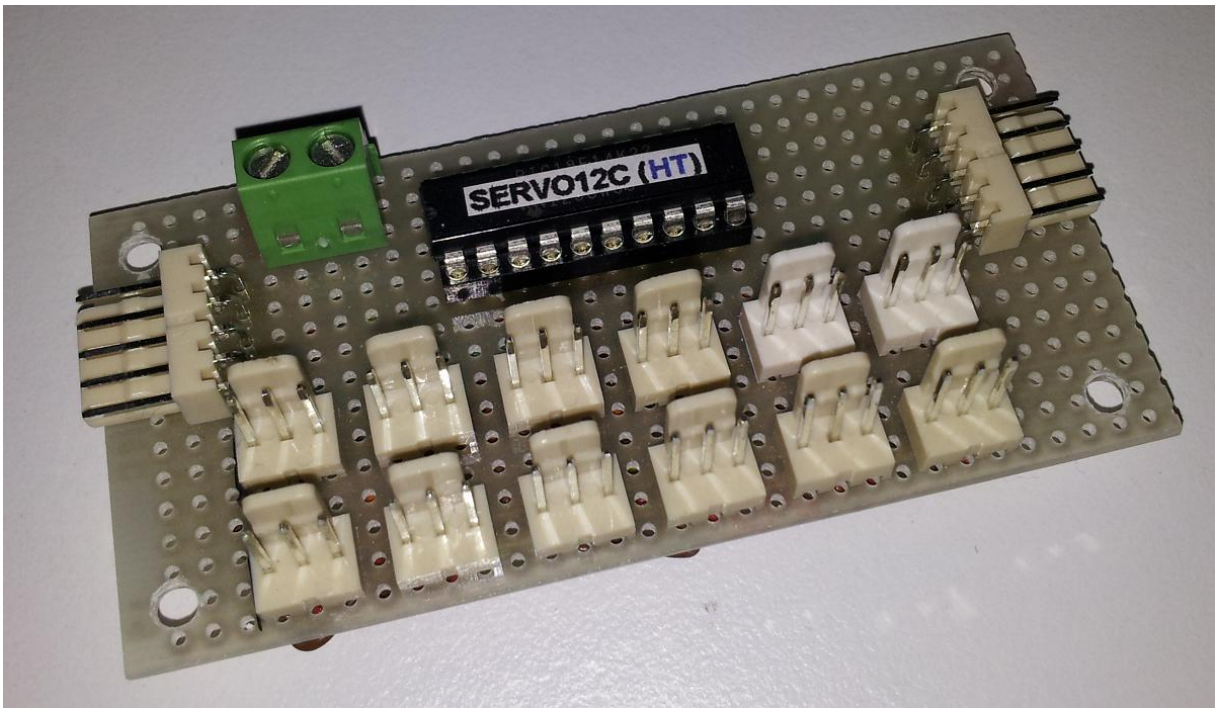


Figure 24: Example 12 channel servo extension, controlled via I2C

Export to EXCEL

With only one single mouse click the 'Export to EXCEL' function compiles the complete project documentation for all connected PoKeys56E® device.

Prerequisite: Microsoft EXCEL® installed on your computer

➔ *File / Export to EXCEL*

	A	B	C	D
1	**FS Symphony**			
2	**Configuration Summary**			
3	IP Address:	192.168.2.31		
4				
5	PWM Frequency:	400 Hz		
6	Encoder Sampling rate:	2		
7	Display Driver Boards:	0		
8	PoKeys Ext:	NO		
9				
10	**Pin No**	**Data Type**	**SIOC Variable**	**FS Control**
11	1	Digital Input		PM AFDS TEST-1 SW
12	2	Digital Input		PM AFDS TEST-2 SW
13	3	Digital Input		PM FMC-P/RST SW
14	4	Digital Input		PM AT-P/RST SW
15	5	Digital Input		PM AP-P/RST SW
16	6	Digital Input	3111	Master Dim Switch SW
17	7	Digital Input	9320	Master Lights Test SW

Figure 25: Example of project documentation, compiled by FSSymphony.

Session Log

FSSymphony provides a comprehensive session log file with system information.

The log file records system information, warnings, and errors:

- **Info**: Informational and debug messages
- **Warning**: Warnings that don't cause an actual error, but could lead to a system malfunction
- **Error**: Fatal errors that cause a malfunction

All messages are formulated in clear, simple and accessible language with the view to help you to analyze system failures.

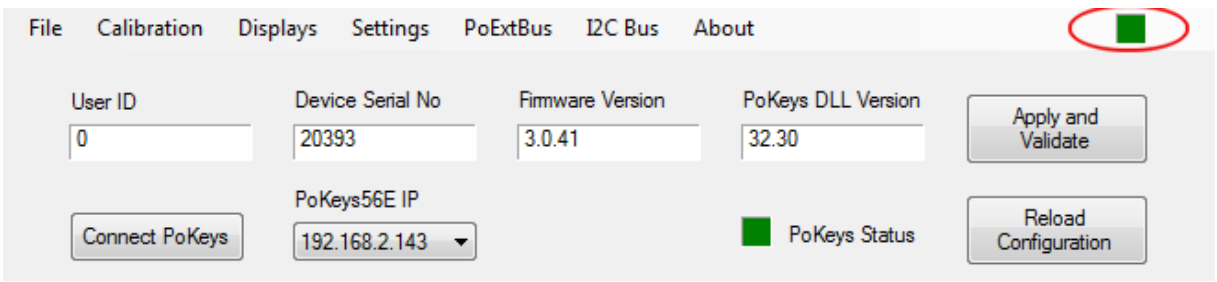


Figure 26: Session Log Summary indicator

FSSymphony indicates with a ‘Session Log Summary’ indicator the health state of the system.

Green - No warning or error recorded since last time the log was reviewed
Yellow - At least one warning was recorded
Red - One or more error entries

In order to review the session log click either on the ‘Session Log Summary’ indicator or

➔ *File / Open Logfile*

Open the session log file resets the ‘Session Log Summary’ indicator to ‘green’.

```
FSSymphony Log File
Copyright (c) 2011 / 2012 by Ruediger Ebert, http://www.flying-the-winglets.de


Info :2012-11-17 09:51:45 Starting application
Info :2012-11-17 09:51:45 FSSymphony version: 1.1.6.0
Info :2012-11-17 09:51:45 OS version: Microsoft® Windows Vista™ Home Premium
Info :2012-11-17 09:51:46 Running on 32 bit system
Info :2012-11-17 09:51:46 Culture setting: de-DE
Info :2012-11-17 09:51:46 Culture setting decimal separator: ','
Info :2012-11-17 09:51:46 Culture setting group separator: '.'
Info :2012-11-17 09:51:51 Starting PoKeys ethernet discovery process
Info :2012-11-17 09:51:52 Found 2 devices
Info :2012-11-17 09:51:52 IP addresses are: 192.168.2.160, 192.168.2.143,
Info :2012-11-17 09:51:52 Reading xml configuration file
Info :2012-11-17 09:51:52 PoKeys56E communication protocol: UDP
Info :2012-11-17 09:51:52 Configuration successfully loaded
Info :2012-11-17 09:51:52 Starting PoKeys ethernet discovery process
Info :2012-11-17 09:51:53 Found 2 devices
Info :2012-11-17 09:51:53 IP addresses are: 192.168.2.143, 192.168.2.160,
Info :2012-11-17 09:51:53 Trying to connect IP 192.168.2.160
Info :2012-11-17 09:51:53 Successfully connected to PoKeys device
Info :2012-11-17 09:51:53 Firmware version: 3.0.41
Info :2012-11-17 09:51:53 Trying to connect IP 192.168.2.143
Info :2012-11-17 09:51:53 Successfully connected to PoKeys device
Info :2012-11-17 09:51:53 Firmware version: 3.0.41
Info :2012-11-17 09:51:53 PoKeys DLL version: 32.30
Info :2012-11-17 09:51:53 Trying to connect FSUIPC
Info :2012-11-17 09:51:54 Starting thread: 'B737 flaps system'
```

Figure 27: Log file example

A new log file is created with each start of FSSymphony. If you want to save a log file for further analysis you have to do this prior terminating FSSymphony. To do so, open the log file and use ‘Save’ from the ‘Notepad’ menu.

B737 Goodies

B737 Flaps Position Indicator Calibration

For the time being the B737 Flaps Position Indicator is only supported for PoKeys56E® PWM outputs, not for I2C.

Prerequisites:
- ‘Servo’ selected as PWM Frequency
- Flap Position indicator is assigned to one of the PoKeys56E® PWM outputs

- Flight Simulator is up and running, B737 flight model is selected
- Flap lever in ‘UP’ position

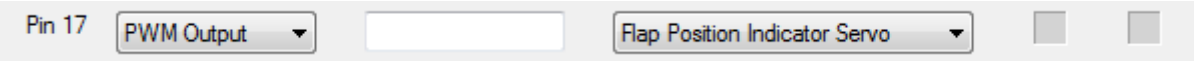


Figure 28: Example of the flap gauge assignment to a PWM output

Open the ‘Flap Position Indicator dialog and follow the instruction given on that form.

➔ *Calibration / Servo / Flaps Position Indicator*

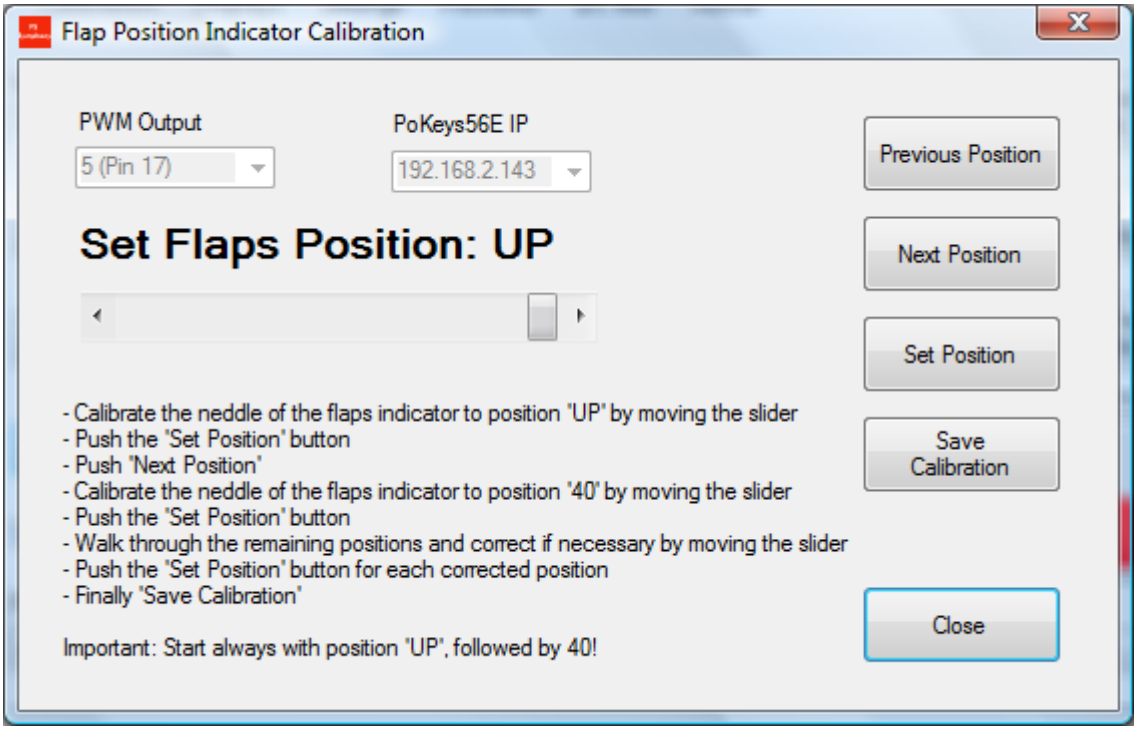


Figure 29: B737 Flaps Position Indicator Calibration

With starting the Flap Position Indicator Calibration dialog, the PWM output and the PoKeys56E® IP address of the flap gauge configuration is shown.

Note:
I could not test the ‘Flaps Position Indicator Calibration’ facility with many gauges from different manufacturers. It would be great to get some feedback from users regarding functionality with DIY gauges and commercial products.

LE Flaps Transit and LE Flaps Extended Lights

The state of both indicators is simulated by FSSymphony as follows:

Flaps position indicator between	LE Flaps Transit Light	LE Flaps Extended Light
Up - 1	ON	OFF
1 - 2	OFF	ON
2 - 5	OFF	ON
5 - 10	ON	OFF
Flaps >= 10	OFF	ON

Table 1: Overview flaps lights

Functional check:
Move the flaps lever to the different positions and check whether the indicators behave according to the table above. If not open the flaps setting dialog and perform the reference value adaptation to your flight model.

➔ *Settings / Flaps*

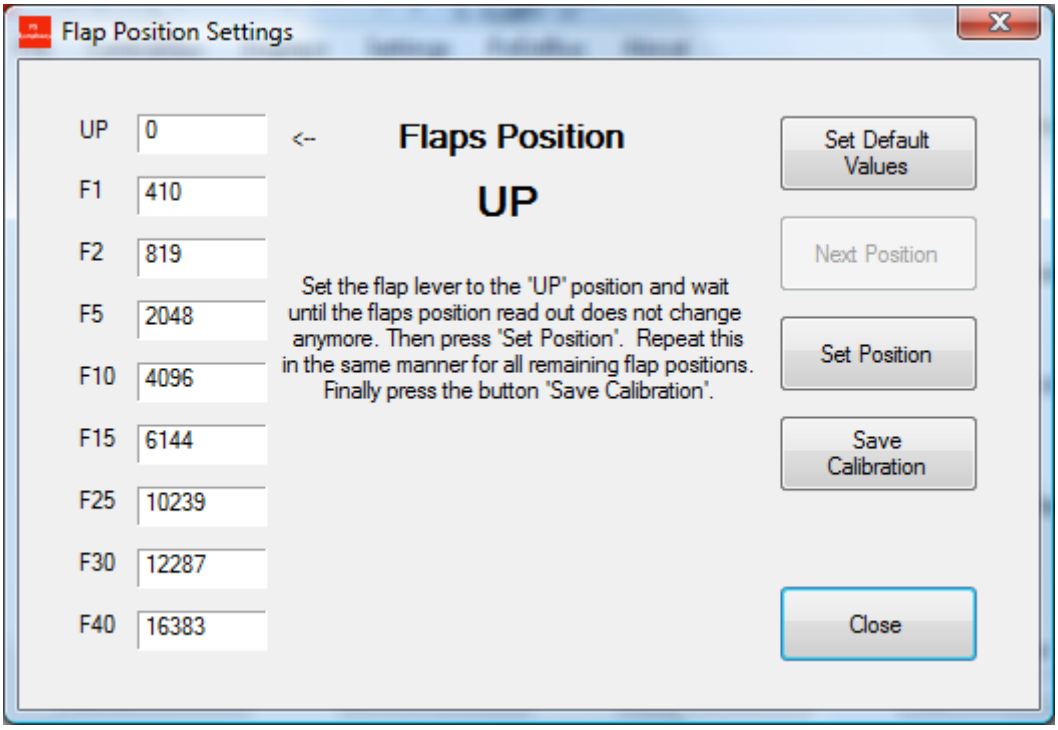


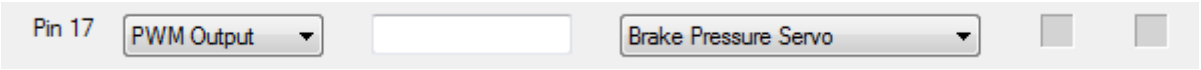
Figure 30: Dialog for setting the flaps reference values

Note: The button ‘Next Position’ was prepared for further development and is not active in the current version.

B737 Brake Pressure Indicator

FSSymphony supports the B737 ‘Brake Pressure Indicator’ through own logic, but also supports the corresponding TSR offset for B737 cockpits using that add-on.

I have done the tests with the brake pressure gauge from Sismo-Soluciones. It should, however, also work with with DIY solutions and other manufactures.



In case you have TRS Auto Brake installed:

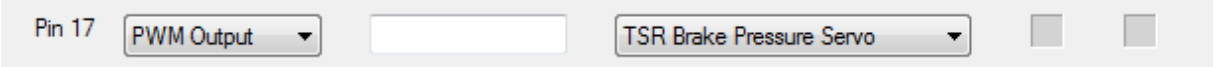


Figure 31: Assignment of B737 brake pressure gauge to a PWM output

In order to calibrate the min / max position of the gauge needle use the generic servo calibration facility.

➔ *Calibration / Servo / Generic*

Refer also to chapter: '*Servo Calibration Facility'*

Functional check:
With starting your cockpit software the gauge should indicate a residual pressure of approx. 1.000 psi. With hydraulic pressure available the gauge should indicate between 2.900 psi and 3.000 psi.

Note:
If you do not have TSR Autobrake running then FSSymphony uses either Project Magenta hydraulic B pressure to control the brake pressure gauge or, without PM, FSSymphony simulates hydraulic B pressure with engine 1 hydraulic pressure available.

B737 Auto Brake Selector and Disarm Light

FSSymphony provides a very well modeled auto braking system, 'as real as it gets'[1].

Auto Brake arm:
- Auto Brake selector 1 – 2 – 3 – Max
- No fault in Antiskid system
- Aircraft in air mode or On Ground: Both trust levers must be on idle

➔ Speed brake lever must be DOWN detent when selecting Auto Brakes

Disarm Light illuminated:
- RTO mode selected on ground (illuminates for one to two seconds then extinguishes)
- Manual brakes applied during RTO or landing
- Landing made with RTO selected
- Thrust lever(s) advanced during RTO or landing
- Speed Brake lever moved to down detent during RTO or landing

[1] According to the B737 FCOM (Flight Crew Operations Manual) and B737 Management Reference Guide

Disarm Light extinguished:
- Auto Brake select switch set to OFF
- Auto brakes armed.

B737 Backlit Control

For the backlit brightness control FSSymphony provides the following:

- CPT main panel light control
- FO main panel light control
- AFDS flood light control
- Background control

Prerequisites:
- Backlit is build up with LED's
- Common ground for LED's
- 400 Hz selected as PWM frequency

Figure 32: Example analog input and PWM output configuration for backlit control

For each LED group one PWM output and a potentiometer are required.

For hardware requirements and wiring see chapter '*Pulse Width Modulation'*, Figure 13: Example for backlit dimming with PWM and a power MOSFET.

B737 Master Dim

With the B737 'Master Dim Switch' all system lights on forward and aft overhead panels, and some lights on Captain and First Officer panels are set to low brightness.

FSSymphony supports this function for the main panels by offering an option to control the common ground of those system lights (LED's) via pulse width modulation.

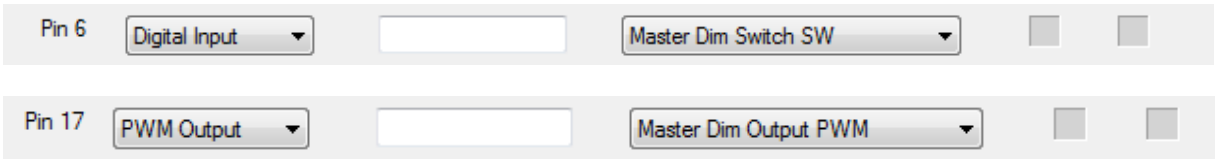


Figure 33: Master Dim Switch applied via a PoKeys56E® input to the internal logic of FSSymphony. The PWM output controls the common LED ground via a power MOSFET.

In order to set the brightness for the dim state open:

➔ *Settings / B737 / Master Dim*

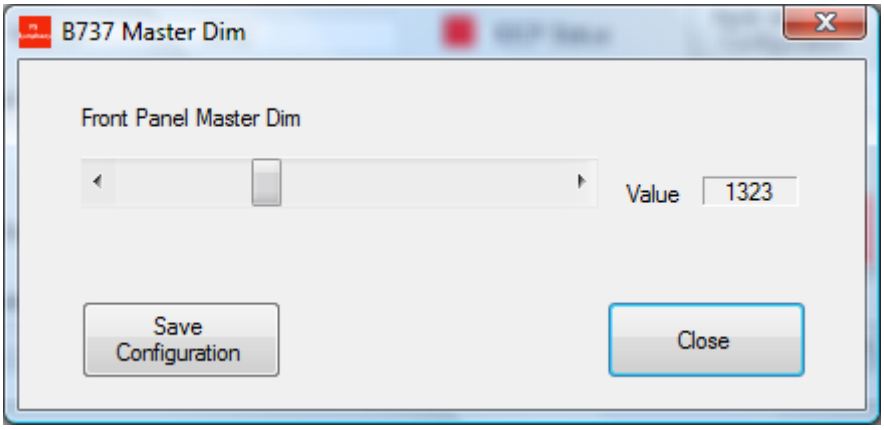


Figure 34: Brightness control for the 'Master Dim' state

With opening the dialog the concerned system lights of the front panels get illuminated and the reduced brightness for the 'master Dim' function can be set by moving the slider. Finally press the 'Save Configuration' button.

B737 Master LightsTest

Illuminates all system lights on forward and aft overhead panels, and some lights on Captain and First Officer instrument panels to full brightness.

FSSymphony supports this function for the concerned system lights on the Captain and First Officer instrument panels.

Figure 35: Configuration for B737 Master Lights Test

B737 Autopilot / Autothrottle Indicators on AFDS Panel[2]

FSSymphony supports the AFDS panel as follows:

Autopilot (A/P) Disengage Light
Illuminated (red)
- flashes when autopilot has disengaged
- reset by pushing disengage
- disengage light test switch held in position 2

Illuminated (amber) –
- steady – disengage light test switch held in position 1

Autothrottle (A/T) Disengage Light

[2] For full functionality Project Magenta is required. Function of test switches are usable without PM.

Illuminated (red)
- flashing - autothrottle has disengaged
- steady - disengage light test switch held in position 2

Illuminated (amber) –
- steady -disengage light test switch held in position 1

TEST 1
- Illuminates autopilot/autothrottle disengage and FMC alert lights steady amber

TEST 2
- Illuminates autopilot/autothrottle disengage lights steady red and FMC alert light steady amber

FMC Alert Light
Illuminated (amber)
- an alerting message exists for both CDUs
- test switch is in position 1 or 2.

Push – both pilots' FMC alert lights extinguish

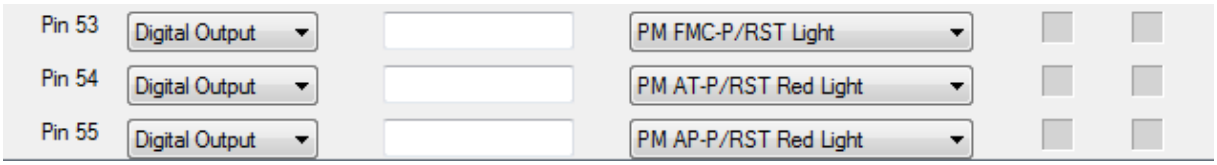


Figure 36: Example for AFDS panel configuration, AFDS red lights and FMC amber light

General Goodies

Generic Clock

FSSymphony provides a clock implementation with UTC, local time, and timer (CHR).

Prerequisits:
- Display driver board from FlightSimParts.eu

For configuration open

➔ *Display / Configuration*

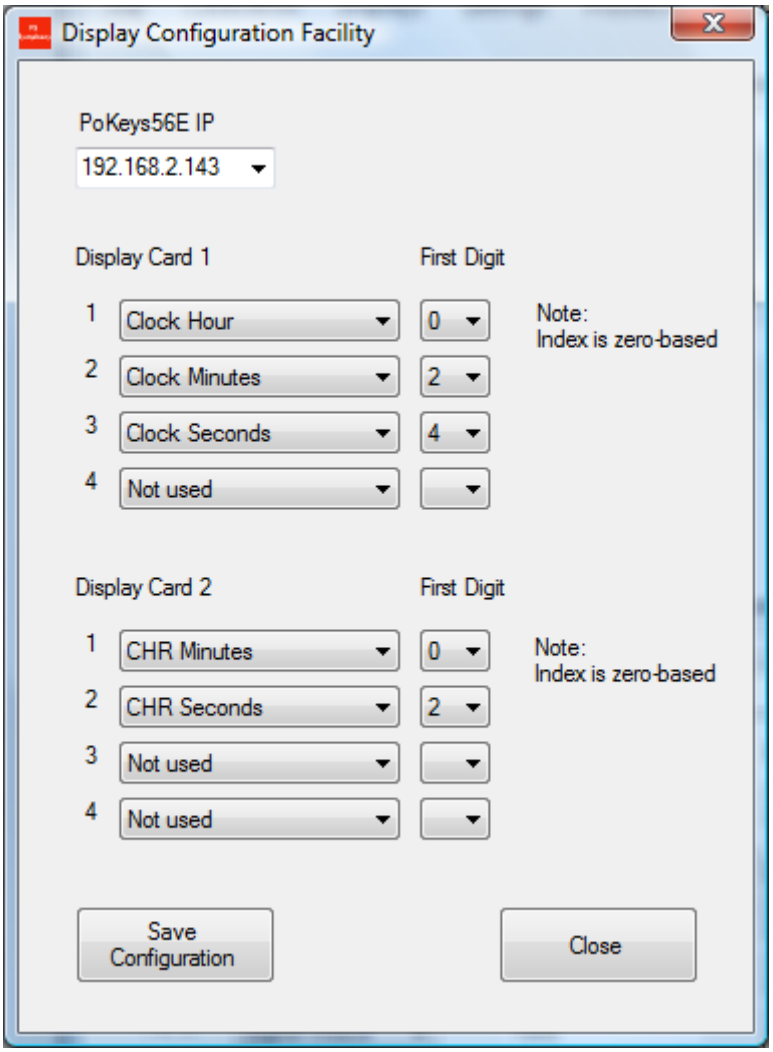


Figure 37: Configuration example for generic clock

The following clock functions are implemented:

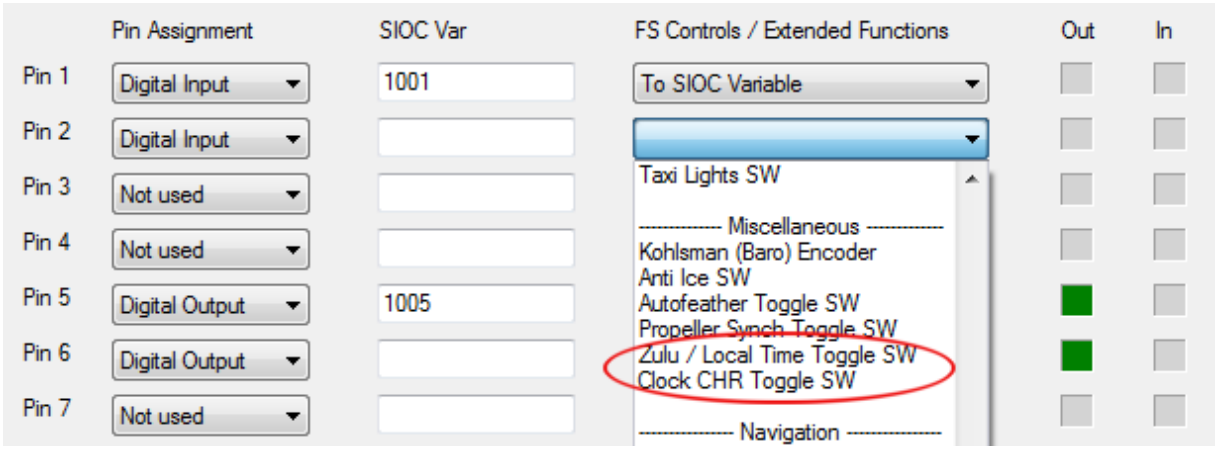


Figure 38: Configuration of generic clock functions

For one of the next FSSymphony releases a complete implementation of the B737 clock is planned.

Jet 45 Goodies

Shortly before completion of FSSymphony Version 1.5 I was asks to implement some Jet45 (http://www.flightdecksoft.com/) encoder offsets. The following are supported:

- MFD 1 Encoder
- MFD 2 Encoder
- PFD 1 Minimums Encoder
- PFD 2 Minimums Encoder
- DU1 Dimming Encoder
- DU2 Dimming Encoder
- DU3 Dimming Encoder
- DU4 Dimming Encoder
- RMU 1 Inner Encoder
- RMU 1 Outer Encoder
- RMU 2 Inner Encoder
- RMU 2 Outer Encoder

If someone is interested in a larger support of Jet45 please let me know.

SIOC Support

FSSymphony provides a direct interface to the OpenCockpits IOCP server. Thus any input can be assigned to a SIOC variable, or output respectively. Use the following assignments from the FS Control selection:

- 'From SIOC Variable' (for Outputs)
- 'To SIOC Variable' (for Inputs)

SIOC variables assigned to PoKeys56E® inputs are set to '1' while the input signal is on GND, e.g. closed switch. Reference: PoKeys56E user manual (Chapter 'Connection common peripherals to PoKeys devices'.

If you want to set an output of PoKeys56E® active (High State +3.3V) then set the related SIOC variable to '1'.

SIOC Examples

For Inputs:


```
var 2400, name P_IN_10 // Input from PoKeys56E
{
..... Your SIOC Code
}
```

Input pin 10 of Pokeys56E assigned to var 2400, named *P_In_10*. Whenever the state of the input pin 10 changes the SIOC script will be executed.

For Outputs:


```
var 2005, name P_Out_ 20  // Output PoKeys56E led indicating parking brake set
var 2501 Link FSUIPC_IN Offset $0BC8 Length 2 // parking brake state
 {
   IF v2501 = 0
   {
     & P_Out_ 20  = 0
   }
   ELSE
   {
     & P_Out_ 20 = 1
   }
 }
```

Output pin 20 becomes active (High State) when the aircraft' s parking brake is set and vice versa.

For Encoders:

Figure 39: Encoder connected to pins 13 and 14, assigned to SIOC variable 3002.

```
var 3000 Link FSUIPC_OUT Offset $3110 Length 4
var 3001, name Enc_Value
var 3002, name Enc2 // Input from Encoder connected to PoKeys56E®, pins 13 and
14
{
  If &Enc2 > &Enc_Value
  {
  v3000 = 65883 // FS Control Kohlsman increment
  v3000 = DELAY 0 10
  }
  Else
  {
  v3000 = 65884 // FS Control Kohlsman decrement
  v3000 = DELAY 0 10
  }
 &Enc_Value = &Enc_Input
}
```

With each encoder detent the baro setting for the altimeter is changed by one step. Depending on the rotating direction it is either increased or decreased.

Note:
The encoder example demonstrates the interfacing of an encoder via PoKeys56E® to SIOC. However, FSSymphony offers a more simple way than the example shows, assign the encoder to the FS Control ‘Kohlsman (Baro) Setting’. That’s all you have to do. FSSymphony will do the rest for you.

Figure 40: Example of encoder connected to pins 13 and 14 of PoKeys56E®

Extras

All Light Test

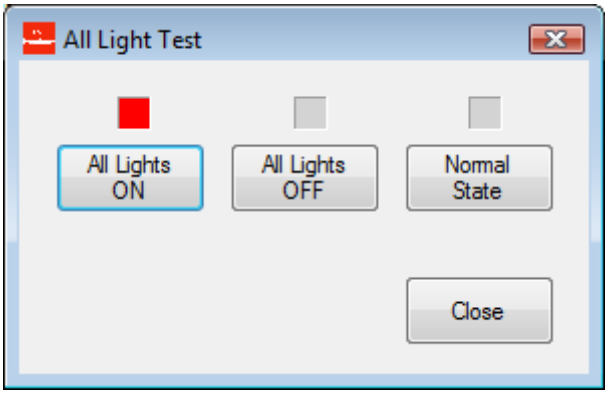


Figure 41: The ‘All Light Test’ an easy means to check all cockpit indicators

The ‘All Light Test’ facility provides a means to set all as ‘Light’ defined outputs to ‘ON’, ‘OFF’ and back to the ‘Normal State’.

Expert Mode

The expert mode enables the experienced user to define own functions, including manipulating offsets and doing logical comparison. In this way, cockpit builders can solve almost each interfacing issue in a very strait forward way.

Note: I have included some examples of how to use the expert mode. Due to lack of time I cannot give any engineering support regarding specific implementation issues.

The examples which I added are based on the FSX and the default B737. Most of the demonstrated functions are already available as predefined functions within the ‘FS Controls / Extended Function’ dropdown list. However, I did it in this way to have a common base at least with FSX users.

With opening the expert mode for the first time a new empty table is generated. You can then add your expert functions. For each function you have to enter the following:

- Name
- Offset Address
- Signal Direction*
- Var Type*
- IO Type*
- Operation*
- Condition
- Description

* Click the field with the left mouse button and then open the context menu with the right mouse button. Direct input in these fields is not possible.

Except the description field all others are mandatory.

Start from the left to the right in each row to define your expert functions.

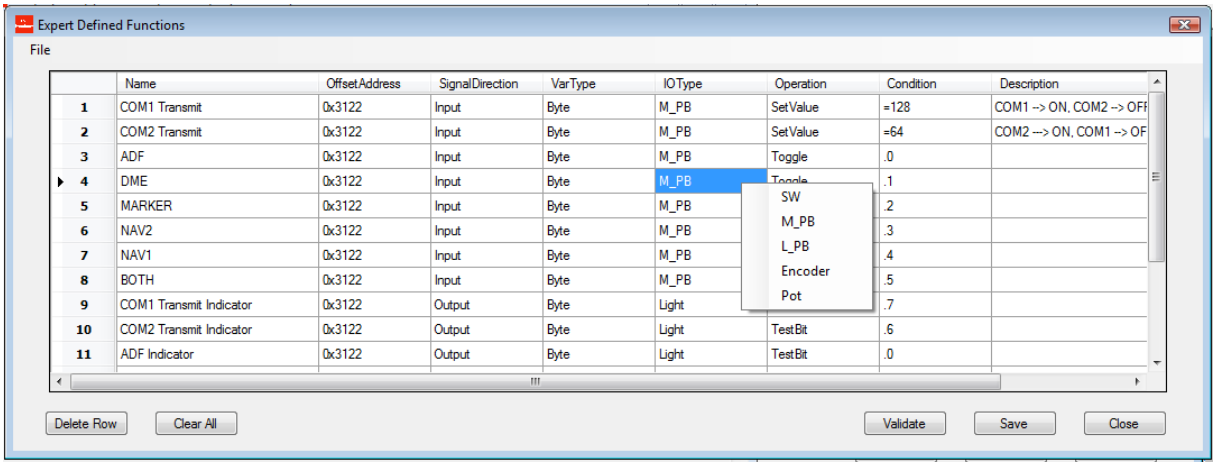


Figure 42: The 'Expert Mode' enables the user to interface his any cockpit without much effort to the flight simulator software

Name
Alphanumeric, max 26 Characters, has to be unique

Offset Address
Address of the function. The address for a specific function is usually given by the vendor of the hardware or software. For standard offsets check Peter Dowson's documentation. Offset addresses have to start with the prefix 'x0' followed by a 4 digit hexadecimal address.

Signal Direction
Can be either input or output

Var Type
The following types are supported:

- Byte
- Short
- UShort

- Integer
- UInteger

Float is not supported for the time being.

If you are not familiar with these you can find many good explanations in the Internet. In a glance:

Byte	1 byte	0 through 255 (unsigned)
Short	2 bytes	-32,768 through 32,767 (signed)
UShort	2 bytes	0 through 65,535 (unsigned)
Integer	4 bytes	-2,147,483,648 through 2,147,483,647 (signed)
UInteger	4 bytes	0 through 4,294,967,295 (unsigned)

IO Type
For input as signal direction the following IO types are available:

- SW — Toggle switch or logical signal created by other hardware or software
- M_PB — Momentary push button
- L_PB — Simulates a latched push button
- Pot — Analog value from a potentiometer. Use ‘UShort’ as VarType. Analog input signal ranges from 0…4095
- Encoder — Encoder signal. Use ‘UShort’ as VarType, except you want to use the encoder as pseudo potentiometer. See additional comment on the next page.

For outputs:

- Light — Control signal for indicators
- Gate — Signal to control other hardware or software
- Servo — For gauges

Operation
For input as signal direction the following IO types are supported:

- Set Value — The value of the assigned offset is set according to the assignment in the condition field
- Set Bit — Bit operation, the bit specified in the condition field be set to ‘1’
- Clear Bit — Bit operation, the bit specified in the condition field be set to ‘0’
- Toggle — Toggles the specified bit
- INC/DEC — Only for ‘Encoder’ as input type. Increases / Decreases the offset value with each encoder detent as defined in the condition field

As outputs:

- Test Value — The value of the assigned offset is tested according to the Comparison operator in the condition field
- Test Bit — A bit state of the assigned offset is tested according to the definition in the condition field
- Set PWM — Only for servo as IO type. The pulse width is set according to the offset value. Use var type 'Byte' for a value range from 0….255, var type 'UShort' for a range from 0 to 4095. FSSymphony scales the value for you. For min / max adjustment of the gauge use the 'Generic Gauge Calibration Facility'.

Condition

Set Value — Use the equal sign '=', followed by the value you want to set the offset. Exception: if you want to set the offset value to the digital equivalent of an analog input (input type 'POT') then no further value right to the equal sign is permitted. If operation is set to INC / DEC the number right to the equal sign determines the step size with each encoder detent.

Bit manipulation — Single bit manipulation is characterized by a dot '.', followed by the bit number. Bits are indexed from 0, e.g. byte from 0 through 7

Test Value — The value of the offset is tested according to the comparison operator. The following operators can be used:

= equal
> greater than
< less than
! unequal

Encoder as Potentiometer

For special cases you might want to use encoders instead potentiometers. For this FSSymphony offers the necessary functionality. Select 'Byte' as VarType for Encoder operation. This will let FSSymphony to process the encoder values in a special way.

The range then is von 0 … 255 and FSSymphony remembers the last value prior switch-off at the next start of the system. The step size for INC/DEC should be set to =10

Validate

After you have entered your definitions use the validate mode to check the validity of your entries. Notepad opens afterwards and shows the validation report.

Remark: If there is any empty row, except the one marked with an '*', delete this (these) line(s) prior validating or saving the expert functions.

Save
After all press the ‘Save’ button to store your expert defined functions. In order to get them effective FSSymphony needs to be restarted. After the restart the defined functions are available in the ‘FS Controls / Extended Functions’ drop down list of the main dialog. Scroll down to the end of the list to get them. You can now assign them to PoKeys56E inputs / outputs.

Delete Row and Clear Row
I think the function of these buttons is self-explanatory.

File Menu

Backup / Restore
Enables you backup and restore your expert defined functions. For safety reasons you should always have an up-to-date backup.

Append
Makes it possible to append definitions from file to those that already exist. In this way you can merge expert defined definitions in an easy way, e.g. from other users, exported with the backup functionality.

Export to EXCEL
This lets you compile a complete documentation of your expert defined functions just with one single click. Microsoft EXCEL® needs to be installed on your computer for this option.

Examples
The FSSymphony V2.0 download package includes the following examples:

FSX_B737_Default_AudioPanel.xml
FSX_B737_Default_Throttle.xml
FSX_B737_Default_FWDOverhead.xml
FSX_B737_Default_MCP.xml
FSX_B737_ Default_SteeringTiller.xml

You can use the ‘Restore’ or ‘Append’ option of the ‘Expert Mode’ to load these examples. Even the examples are made for the default B737 from FSX, most can be used also with other aircrafts and P3D.

Overview of Supported Functions

FS Symphony Version 2.0

Auto Pilot

AP Altitude Hold SW
AP Airspeed Hold SW
AP Approach Hold SW
AP AT ARM SW
AP AT TOGA SW
AP Back Course Hold SW
AP FlightDirector SW
AP Heading Lock SW
AP Mach Hold SW
AP Master SW
AP NAV1 Lock SW
AP Vertical Speed Hold SW

AP Airspeed Hold SW Light
AP Altitude Hold SW Light
AP Approach Hold SW Light
AP AT ARM SW Light
AP Back Course Hold SW Light
AP Heading Hold SW Light
AP Mach Hold SW Light
AP NAV1 Lock SW Light
AP Vertical Speed Hold SW Light

AP Altitude Encoder
AP Heading Bug Encoder
AP IAS / Mach Encoder
AP Vertical Speed Encoder
AP VOR1 OBI Encoder
AP VOR2 OBI Encoder

Brakes

Auto Brake RTO SW
Auto Brake OFF SW
Auto Brake 1 SW
Auto Brake 2 SW
Auto Brake 3 SW
Auto Brake Max SW

Parking Brake SW

Parking Brake SW Light

Brake Left Axis Pot
Brake Right Axis Pot

Electric
Avionics Master SW
Master Battery SW

Engine 1
Eng1 Magneto Both SW
Eng1 Magneto Left SW
Eng1 Magneto Off SW
Eng1 Magneto Right SW
Eng1 Magneto Start SW
Eng1 Generator SW
Eng1 Cut Off / IDLE SW

Eng1 TQ Lever Axis Pot
Cowl Flaps 1 Axis Pot
Eng1 Mix Lever Axis Pot
Prop1 Pitch Axis Pot

Engine 2
Eng2 Magneto Both SW
Eng2 Magneto Left SW
Eng2 Magneto Off SW
Eng2 Magneto Right SW
Eng2 Magneto Start SW
Eng2 Generator SW
Eng2 Cut Off / IDLE SW

Eng2 TQ Lever Axis Pot
Eng2 Mix Lever Axis Pot
Cowl Flaps 2 Axis Pot
Prop2 Pitch Axis Pot

Fuel
Fuel Pump SW
Fuel Selector Off SW
Fuel Selector All SW
Fuel Selector Left SW
Fuel Selector Right SW

Gear
Gear Down SW
Gear Up SW

Gear Down Nose Light
Gear Transit Nose Light
Gear Down Right Light
Gear Transit Right Light
Gear Down Left Light
Gear Transit Left Light

Primary Flight Controls
Ailerons Axis Pot
Elevator Axis Pot
Rudder Axis Pot

Secondary Flight Controls
Aileron Trim Left SW
Aileron Trim Right SW
Flaps Up SW
Flaps Down SW
Flaps 1 SW
Flaps 2 SW
Flaps 3 SW
ELEV Trim Down SW
ELEV Trim Up SW
Rudder Trim Left SW
Rudder Trim Right SW
YAW Damper SW

ELEV Trim Axis Pot
Flaps Lever Axis Pot
Spoiler Lever Axis Pot

Aircraft Lights
Beacon Light SW
Landing Lights SW
Nav Lights SW
Pitot Heat SW
Strobe Lights SW
Taxi Lights SW

Miscellaneous
Kohlsman (Baro) Encoder
Anti Ice SW
Autofeather Toggle SW
Propeller Synch Toggle SW
Zulu / Local Time Toggle SW
Clock CHR Toggle SW

Navigation
GPS / NAV1 Toggle SW
DME Toggle SW

Inner Marker Light
Middle Marker Light
Outer Marker Light

Radios
COM1 Standby Swap SW
COM2 Standby Swap SW
NAV1 Standby Swap SW
NAV2 Standby Swap SW

COM1 STBY Whole Encoder
COM1 STBY Fract Encoder
COM2 STBY Whole Encoder
COM2 STBY Fract Encoder

NAV1 STBY Whole Encoder
NAV1 STBY Fract Encoder
NAV2 STBY Whole Encoder
NAV2 STBY Fract Encoder

ADF1 Whole Encoder
ADF1 1 Encoder
ADF1 10 Encoder
ADF1 100 Encoder
ADF1 TENTHS Encoder
ADF2 Whole Encoder
ADF2 1 Encoder
ADF2 10 Encoder
ADF2 100 Encoder
ADF2 TENTHS Encoder

XPNDR 1 Encoder
XPNDR 10 Encoder
XPNDR 100 Encoder
XPNDR 1000 Encoder

Audio Sel COM1 SW
Audio Sel COM2 SW
Audio Sel BTH SW
Audio Sel NAV1 SW
Audio Sel NAV2 SW
Audio Sel MKR SW

Audio Sel DME SW
Audio Sel ADF1 SW
Audio Sel ADF2 SW

Audio Sel COM1 Light
Audio Sel COM2 Light
Audio Sel BTH Light
Audio Sel NAV1 Light
Audio Sel NAV2 Light
Audio Sel MKR Light
Audio Sel DME Light
Audio Sel ADF1 Light
Audio Sel ADF2 Light

B737 Goodies

Master Lights Test SW
Master Dim Switch SW
Master Dim Output PWM

Auto Brake Disarm Light
Anti-Skid INOP Light
Speed Brake Armed Light
Speed Brake Extended Light
Speed Brake Do Not Arm Light
LE Flaps Transit Light
LE Flaps Extended Light

Flap Position Indicator Servo
Yaw Dumper Servo

Brake Pressure Servo

CPT Main Panel Light Pot
FO Main Panel Light Pot
AFDS Flood Light Pot
Background Light Pot

CPT Main Panel Light Control PWM
FO Main Panel Light Control PWM
AFDS Flood Light Control PWM
Background Light Control PWM

Project Magenta SYS

PM Fire Warn SW
PM Master Caution SW
PM Recall SW

PM Eng1 Cut Off / IDLE SW
PM Eng2 Cut Off / IDLE SW

PM Batt PWR SW

PM Fire Warn Light
PM Master Caution Light
PM Six Pack FLT CONT Light
PM Six Pack IRS Light
PM Six Pack FUEL Light
PM Six Pack ELEC Light
PM Six Pack APU Light
PM Six Pack OVHT/DET Light
PM Six Pack ANTI-ICE Light
PM Six Pack HYD Light
PM Six Pack DOORS Light
PM Six Pack ENG Light
PM Six Pack OVERHEAD Light
PM Six Pack AIR COND Light

PM Gear Down Nose Light
PM Gear Transit Nose Light
PM Gear Down Right Light
PM Gear Transit Right Light
PM Gear Down Left Light
PM Gear Transit Left Light

PM Starter Solenoid Eng1 Gate
PM Starter Solenoid Eng2 Gate

Project Magenta GC
PM DU SEL CPT ENG PRI SW
PM DU SEL CPT NORMAL SW
PM DU SEL CPT OUTBD PFD SW
PM DU SEL CPT PFD INBD SW

PM DU SEL FO ENG PRI SW
PM DU SEL FO NORMAL SW
PM DU SEL FO OUTBD PFD SW
PM DU SEL FO PFD INBD SW

PM CPT LOW DU PRI SW
PM CPT LOW DU NORM SW
PM CPT LOW DU INOP SW

PM FO LOW DU PRI SW

PM FO LOW DU NORM SW
PM FO LOW DU INOP SW

PM Brightness CPT OUTBD Pot
PM Brightness CPT INBD Pot
PM Brightness FO OUTBD Pot
PM Brightness FO INBD Pot
PM Brightness Lower EICAS Pot
PM Brightness Upper EICAS Pot

PM Fuel Used SW
PM Reset Used SW

PM SPD REF Auto SW
PM SPD REF V1 SW
PM SPD REF VR SW
PM SPD REF WT SW
PM SPD REF VREF SW
PM SPD REF < SW
PM SPD REF SET SW
PM SPD REF Encoder

PM N1 SET Auto SW
PM N1 SET BOTH SW
PM N1 SET 1 SW
PM N1 SET 2 SW
PM N1 SET Encoder

PM GPWS TERR Inhibit SW
PM GPWS Gear Inhibit SW
PM GPWS Flaps Inhibit SW
PM GPWS SYS TEST SW

PM MFD SYS SW
PM MFD ENG SW

PM AFDS TEST-1 SW
PM AFDS TEST-2 SW
PM AP-P/RST SW
PM AT-P/RST SW
PM FMC-P/RST SW

PM Below GS Light
PM Stab Out of Trim Light
PM GPWS INOP Light

PM AP-P/RST Amber Light
PM AP-P/RST Red Light
PM AT-P/RST Amber Light
PM AT-P/RST Red Light
PM FMC-P/RST Light

Project Magenta MCP
PM MCP A/T ARM SW
PM MCP ALT HLD SW
PM MCP APP SW
PM MCP AP Disengage SW
PM MCP c/o SW
PM MCP CMD A SW
PM MCP CMD B SW
PM MCP CMS A SW
PM MCP CMS B SW

PM MCP F/D CPT SW
PM MCP F/D FO SW
PM MCP HDG SEL SW
PM MCP LNAV SW
PM MCP LVL CHG SW
PM MCP N1 SW
PM MCP Speed SW
PM MCP VNAV SW
PM MCP VOR LOC SW
PM MCP V/S SW

PM MCP ALT HOLD Light
PM MCP APP Light
PM MCP A/T ARM Light
PM MCP CMD A Light
PM MCP CMD B Light
PM MCP F/D CPT Light
PM MCP F/D FO Light
PM MCP FLCH Light
PM MCP HDG Light
PM MCP LNAV Light
PM MCP MACH Light
PM MCP N1 Light
PM MCP Speed Light
PM MCP VNAV Light
PM MCP VOR LOC Light
PM MCP V/S Light

PM MCP Altitude Encoder

PM MCP Heading Encoder
PM MCP IAS/MACH Encoder
PM MCP Vert Speed Encoder

TSR
TSR Auto Brake RTO SW
TSR Auto Brake OFF SW
TSR Auto Brake 1 SW
TSR Auto Brake 2 SW
TSR Auto Brake 3 SW
TSR Auto Brake Max SW

TSR AFDS TEST-1 SW
TSR AFDS TEST-2 SW
TSR AP-P/RST SW
TSR AT-P/RST SW
TSR FMC-P/RST SW

TSR AP-P/RST Orange Light
TSR AP-P/RST Red Light
TSR AT-P/RST Orange Light
TSR AT-P/RST Red Light
TSR FMC-P/RST Light

TSR Anti-Skid INOP Light
TSR Auto Brake Disarm Light
TSR Below GS Light
TSR LE Flaps Transit Light
TSR LE Flaps Extended Light
TSR Speed Brake Armed Light
TSR Speed Brake Extended Light
TSR Speed Brake Do Not Arm Light
TSR STAB OUT OF TRIM Light

TSR Brake Pressure Servo

Jet 45 Goodies
MFD 1 Encoder
MFD 2 Encoder
PFD 1 Minimums Encoder
PFD 2 Minimums Encoder
DU1 Dimming Encoder
DU2 Dimming Encoder
DU3 Dimming Encoder
DU4 Dimming Encoder
RMU 1 Inner Encoder

RMU 1 Outer Encoder
RMU 2 Inner Encoder
RMU 2 Outer Encoder

General Goodies
Zulu / Local Time Toggle SW
Clock CHR Toggle SW

Displays
Radios
COMM1 Active
COMM1 STBY
COMM2 Active
COMM2 STBY
NAV1 Active
NAV1 STBY
NAV2 Active
NAV2 STBY
ADF1 Active
ADF1 STBY
ADF2 Active
ADF2 STBY
Transponder

MCP
Altitude
Course A
Course B
AP Heading
AP Altitude
AP Vertical Speed
AP IAS / MACH

Miscellaneous
Clock Hour
Clock Minutes
Clock Seconds
CHR Minutes
CHR Seconds

PM MCPs
PM MCP Heading
PM MCP Altitude
PM MCP IAS/MACH
PM Vertical Speed

PM Electric Meter

PM DC Amps
PM CPS Freq
PM DC Volts
PM AC Amps
PM AC Volts

PM Pressurization
PM FLT ALT
PM LAND ALT

Contact
For any questions, suggestion or bug reporting use the following e.mail address:

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